HOUSE NEAR ROUEN, FRANCE.

From a Negative by F. W. Mills.

PHOTOGRAPHY

FOR

ARCHITECTS,

BY

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PREFACE.

A FEW weeks ago the Author, in the course of spending a pleasant evening with a friend—an architect—the subject of the great advantages which might be obtained by architects from an elementary knowledge of photography was discussed.

This conversation convinced the Author that a book containing short instruction would be of benefit to architects. He has therefore endeavoured to prepare such a one as shall prove useful to them.

F. W. M.

THORNLEIGH,
HUDDERSFIELD,
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CONTENTS.

PAGE

PREFACE ... ... iii.

TABLE OF CONTENTS ... ... v.

PART I.

INTRODUCTION.

DESCRIPTION OF PHOTOGRAPHIC APPARATUS 7

CHAPTER I.

PLATES AND THE DARK-ROOM 11

CHAPTER II.

EXPOSURE OF THE PLATE... 14

CHAPTER III.

NECESSARY SOLUTIONS 19

CHAPTER IV.

DEVELOPMENT OF THE IMAGE 21

CHAPTER V.

DEFECTS IN NEGATIVES AND THEIR REMEDIES ... 24

CHAPTER VI.

DOCTORING AND FINISHING NEGATIVES... 29

CHAPTER VII.

A SIMPLE PRINTING PROCESS 32

CONTENTS—*continued.*

PART II.—CHAPTER VIII.

PAGE

Photographing Interiors 35

CHAPTER IX.

Second Lesson in Development 37

CHAPTER X.

Positive Bromide Printing 41

CHAPTER XI.

Platinotype... 45

CHAPTER XII.

Enlarging on Bromide Paper 51

CHAPTER XIII.

Special Appliances 55

CHAPTER XIV.

Processes for Copying Tracings 60

Appendix 65

Index... 67

INTRODUCTION.

FOR convenience the author has divided his subject into two parts. Firstly, first lessons. Secondly, advanced work and a simple method of copying tracings, etc.

The beginner is recommended to thoroughly master the first part before reading further.

Before commencing to describe the necessary operations, a short description of the various apparatus and chemicals required will not be out of place.

Beware of cheap sets, they are only made for playthings, and really good apparatus may be purchased for little more than their cost.

The most convenient size, and the one recommended by the author, is that known as "whole plate" size. The prints obtained from this measure 8 inches by 6 inches To produce these, the apparatus is neither heavy nor bulky, as it would prove for larger sizes, nor too small for practical purposes, as would be the case with smaller apparatus.

The best known standard sizes of plates (that is, the glasses on which the negatives are taken) are as follows :—

Quarter-plate	$4\frac{1}{2}$	x	$3\frac{1}{4}$	inches	Prints from these will measure half an inch smaller each way.
Half-plate	$6\frac{1}{2}$	x	$4\frac{3}{4}$	,,	
Whole plate	$8\frac{1}{2}$	x	$6\frac{1}{2}$	,,	
	10	x	8	,,	
	12	x	10	,,	
	15	x	12	,,	

The apparatus consists of a camera with double backs, a lens, and tripod, together with other objects as are about to be described.

The camera should possess as few movements as possible, thereby avoiding complications and expense. The necessary ones are:—A rack and pinion adjustment for focussing, a swing back hinged in the centre of the focussing ground glass screen, a reversing back, so that either longitudinal or vertical pictures may be taken, and, lastly, a rising front, in order that the lens may be raised. The whole camera and double backs (to hold two plates each) should be made as light as possible. The camera should be one suitable for a wide-angle lens, the back being made so that it may be placed forward as shown in fig. 1, or else, in certain cases, the bottom board may interfere with the view.

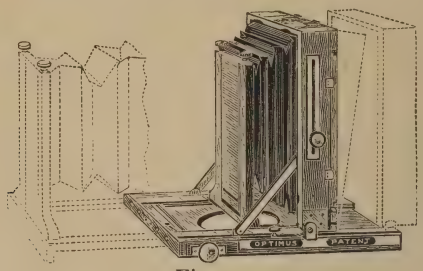


Fig. 1.

The lens should be of the class known as wide-angle rectilinear. A wide-angle lens is one of which the focal length is shorter than the length of the base of the plate employed, that is to say, a wide-angle whole-plate lens should not have a focal length of more than eight inches (the distance from half-

way between the two combinations of the glasses and the focussing place, when an object forty feet away is focussed). The dark metal plates with different sizes of apertures, called stops or diaphragms, should be clearly marked according to the standard of the Photographic Society, the usual sizes of apertures being known as f/16, f/22, f/32, f/44, and f/64, signifying that the diameters of the apertures are $\frac{1}{16}$, $\frac{1}{22}$, $\frac{1}{32}$, $\frac{1}{44}$, and $\frac{1}{64}$ of the focal length of the lens.

However, if the diaphragms purchased with the lens be not marked according to this principle, the reader may easily do so by first focussing some object at some distance from the camera, without placing a diaphragm in the slot, and then measuring the exact distance from the focussing screen to the diaphragm slot, marking this on a slip of paper, and with a pair of dividers opened the distance of the diameter of one of the diaphragms; by pricking the paper ascertain the number of times that it is smaller than the focal length. The result will be, say, for instance, sixteen times; if this be so, mark the diaphragm "f/16," and if 22, mark it "f/22," and so on.*

The glass surfaces of a lens should, when dusty, be carefully wiped with a soft chamois leather, care being taken not to scratch them, as they are made of very soft glass.

---

* To find Dallmeyer's standard, divide the distance in inches between the stop and the focussing screen by the diameter of the stop in inches, square the result, and divide by ten

It may be well to note that a lens should always be kept in a cool place, as what appears to consist of one piece of glass consists, in reality, of a piece of crown and flint glass (cemented together with Canada balsam), which form a combination, heat being always liable to "start," as it is termed, the cement.

The tripod should be light and rigid, with three or four joints, the bottom portion preferably made so as to slide instead of fold.

A yard and a half of *thick* velveteen, a focussing glass, and a case to hold the camera, three dark slides, lens, focussing cloth, etc., will complete the necessary apparatus.

CHAPTER I.

PLATES AND THE DARK ROOM.

IT has already been stated that plates are the glasses upon which the photographs are first taken. These have a coating of a mixture of silver salts and gelatine upon one side, called the film side, which is highly sensitive to light. However, different colours have different effects upon the plates. To explain this it must be first understood that light consists of colours, some of which are chemically actinic, and some are not—red having no effect whatever upon them, while yellow has but little, blue and white have the most. This seemingly strange phenomenon renders photography possible, as the plates are not only made in deep red light, but all subsequent operations such as developing, etc., must be conducted by its aid. The dark room must, therefore, be illuminated by red light.

A butler's pantry at night will be found a most convenient dark room, being provided with a sink and a supply of cold water. For illumination a photographer's red lamp must be purchased. This is usually a three-sided tin lamp for paraffin, or a candle, glazed on two sides with red glass.

A cupboard should here be provided in which to keep measures, developing dishes, plates and chemi-

cals. A list of the necessary chemicals and quantities of the same which are advised to be purchased will be found in the appendix at the end of this book.

A small sponge will be found a great convenience in the dark room, to wipe one's fingers or mop up any chemicals that, through carelessness, have been spilt or splashed about. Before closing this short chapter a word about method will not be out of place. Always, when working, place the small bottles and measures in the same place, so that they may be found by the dim red light of the lamp, without any trouble, thus preventing the risk of upsetting any bottles. Be careful to always wash all developing dishes and measures after use, and put them carefully away, as cleanliness and neatness are points not to be disregarded in photography.

The boxes containing plates must only be opened under the influence of red light. They must also be preserved from damp and heat, or unsatisfactory work will be certain to ensue.

"In the case of a room temporarily used as an operating room, it is well to cover the tables with waterproof or 'American' cloth. A basin or foot-pail may serve as a sink, and any vessel of suitable size and shape may be 'annexed' for water. We have, in an hotel bedroom in Italy, made rapid gelatine emulsion,* coated, dried and developed plates, with some little exercise of ingenuity, but without accident or failure." †

* That is the composition of which the sensitive film to cover the glass plate is made.

† *The Processes of Pure Photography*, page 32, by W. K. Burton and Andrew Pringle. London: Iliffe & Son.

Red light, or a very deep orange, must be used to light the dark room, for the reason that, if a sensitive plate be exposed to the action of the spectrum, it is observed that the red and yellow rays have scarcely any action, while those of the green are but very weak. Light blue produce more effect; dark indigo and violet the most.

A woodcut of the spectrum is given below (fig. 2), which may prove a useful guide to the relative order of the visual rays. Those colours represented at the upper part of the scale have the most actinic power,

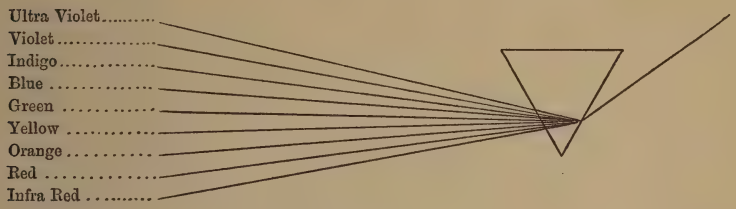


FIG 2.

which decreases as they descend, *i.e.*, red is the least, while violet is the most refrangible.

It is a fact, constantly proved, that a large portion of light which is most actinic for photographic purposes the (ultra-violet rays) is invisible to the eye, and, therefore, it is absolutely impossible to estimate any photographic exposure with anything approaching exactness. Fortunately for the operators, a very wide margin is allowed by all plates.

The photographic plate is but slightly sensitive to very feeble light, and this explains the reason why the shadows in photographs are always lacking in detail.

CHAPTER II.

EXPOSURE OF THE PLATE.

FIRST go into the dark room, shut the door, and light the red lamp, now open a box of plates, and one of your double dark slides. Take two plates out of the box, dust the film side carefully with a broad, soft brush, and place them in the dark slide, the film side of the plates being turned towards the shutters of the double dark slide. Carefully fasten up the remainder of your plates in the box, and daylight may then be permitted in the room.

Now, all being ready, take your camera, camera screw, legs, lens, dark slide, focussing cloth, focussing glass, and a small memorandum book with you to some quiet place on a bright afternoon. The village church, for instance, would be a capital subject. Do not let your first attempts be in a town, as you would be sure to have a crowd around you in a few seconds.

The building should be photographed from such a position that pleasing contrasts of light and shade are visible. The best results are obtained when the rays of light from the sun shine obliquely over one or other of the shoulders of the operator when he is facing the building.

Having arrived at the spot where your first exposure is to be made, open the camera tripod, placing each of the legs about two feet apart, in such

a position that one of them will be pointing directly at you when you are facing the "object" (as it is termed). Open the camera, and screw it on to the tripod, screw on the lens, place stop f/22 in the lens,

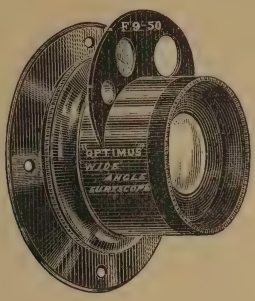


Fig. 3.

or, if it possess a diaphragm plate, as shown in fig. 3, revolve it until the required aperture be in the centre of the lens.

Now place the focussing cloth over your head and the camera, and move the focussing screw backwards and forwards until you can see the object upon the ground glass of the camera. If it appear too large move the camera further away, if too small approach a few yards. When the object has been regulated to the required size, move the leg *nearest to you* until it occupies the centre of the ground glass. If, as will most probably be the case, it has been found necessary to tilt the front of the camera up, the perspective will be noticed to be, to say the least of it, a little original.

To avoid this, one simple rule must most strictly be adhered to, and that is, *that the plate must always be parallel to the object.*

To accomplish this, the back of the camera must be moved on its hinges until the ground glass screen is *perfectly perpendicular.*

As appearances are often deceptive, a plumb-line should always be used; your watch and chain will answer this purpose admirably.

The directions given in the above paragraph *must* be followed, or else every photograph taken, while disregarding them, will produce such absurd perspective as is shown in the illustration A opposite, B showing the result when the swing back was perfectly perpendicular.

The perspective having been attended to, adjust the focus of the lens very accurately, so that you can clearly see the most minute detail. A focussing

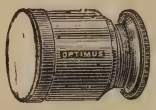
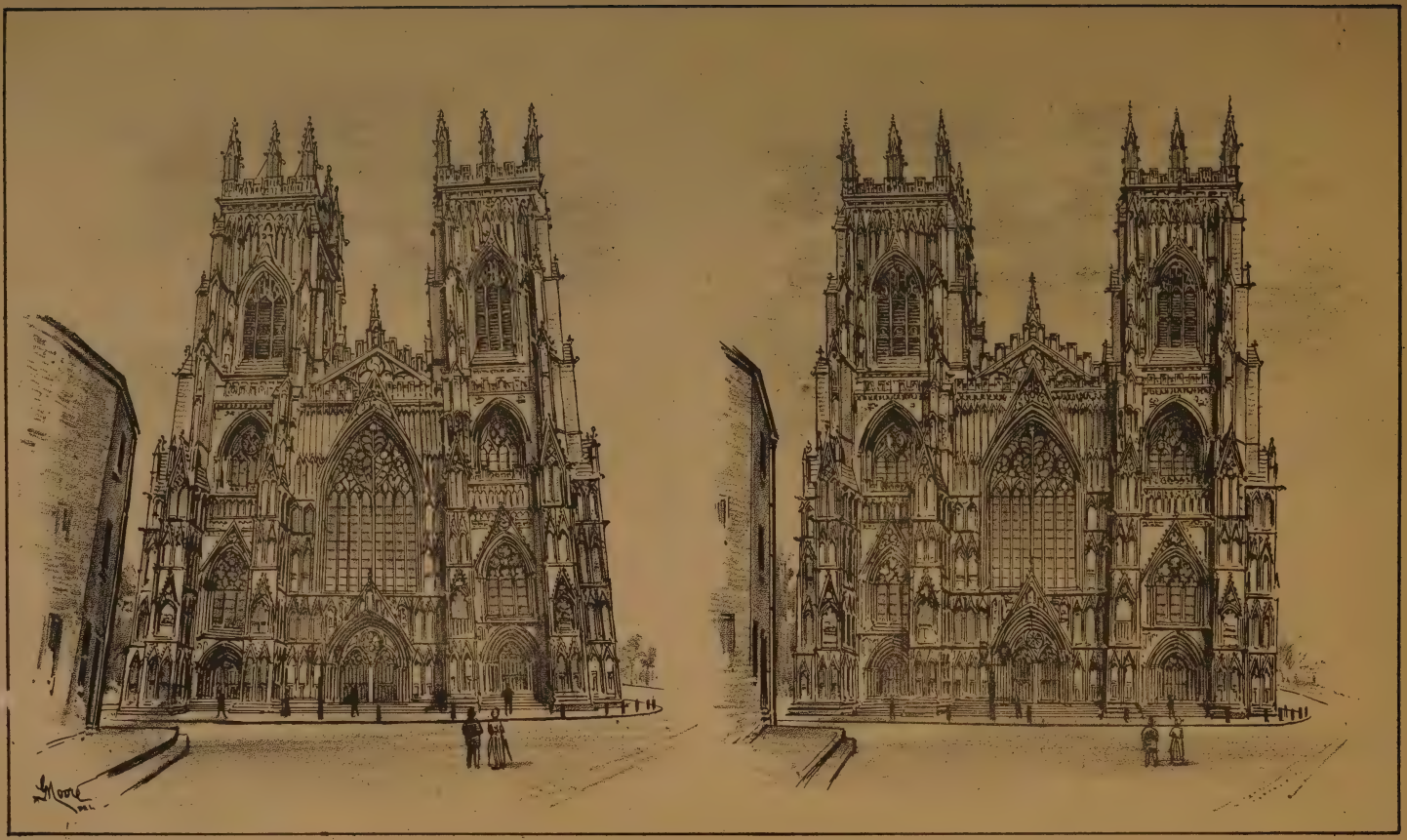


Fig. 4.

glass, as shown in fig. 4, will greatly facilitate this.

Now place a smaller stop in the lens, remembering that the smaller the stop employed the sharper will be the fine detail in the object.

Place the cap on the lens, remove the ground glass screen, and slide in the dark slide, No. 1 side towards the lens, move the catch to fasten it in its place, draw out the shutter (No. 1), and remove the cap for the length of time stated in the following table, taking note of the month, light, stop, and hour of the day.



SOUTH FRONT OF YORK MINSTER.

(*a*) Result when Swing-back was not used.

(*b*) Result when Swing-back was perpendicular.

MONTH.	LIGHT.	TO 11 A.M.				11 A.M. to 2 P.M.				2 P.M. TO 4 P.M.			
		f/22	32	44	64	f/22	32	44	64	f/22	32	45	64
January, October and November	Sunlight	2½s.	5s.	10s.	20s.	1¼s	2½s.	5s.	10s.	3s.	6s	12s	24s.
	Diffused ligh	3s	6s.	12s.	24s	1½s.	3s.	6s.	12s	3½s.	7s.	14s.	27s
February, March and September	Sunlight	1½s.	3s.	6s	12s.	1s.	2s	4s	8s.	½s	1s.	2s	4s.
	Diffused light	1¾s	3½s	7s	14s.	1¼s.	2½s.	5s.	10s.	¾s.	1½s.	3s	6s
April, May and August	Sunlight	1s.	2s.	4s	8s	⅞s.	1¾s.	3½s.	7s	1s	2s	4s	8s.
	Diffused light	1¼s	2½s.	5s	10s.	1¼s.	2¼s.	4½s.	9s.	1¼s.	2½s.	5s.	10s.
June and July	Sunlight	¾s	1½s	3s.	6s	¾s.	1¼s.	2¾s	5s.	⅞s	1¾s	3¾s.	7½s.
	Diffused	1s.	2s.	4s.	8s.	1s.	1¾s.	3¾s.	7s.	1¼s.	2¼s.	4½s.	10s.
December	Sunlight	4½s.	9s	18s.	36s.	3s.	6s.	12s.	24s.	12s	24s.	48s	1½m
	Diffused light	5½s	11s	22s.	44s.	4s.	8s.	16s.	36s.	14s	28s.	46s.	2m

NOTE: "s" stands for seconds; "m" for minutes.

The exposures given in the table will be found correct for most subjects; red brick and very dark buildings require slightly longer.

It is not advisable to take photographs of architectural subjects on a dull day, as detail cannot under that circumstance be shown up, and the picture would be "much the same colour all over."

There are two strange facts that are worthy of attention—(1) When there is an east wind make

the exposure half as much again as that advised in the table. (2) After a light shower the exposure should be slightly curtailed.

After making an exposure do not forget to replace the shutter before removing the dark slide from the camera.

No. of Slide.	Date.	Time of Day.	Light.	Subject.	Lens.	Stop F.	Seconds exposed.	Result	Name of Place	Remarks.

When the exposure has been completed, fill in all the columns of a small note-book, ruled as the sample given here. It will prove invaluable for future reference.

Such books may be purchased, neatly bound, with pencil, at any photographic apparatus dealer's for about one shilling and sixpence.

Great care must be exercised that one plate does not receive two exposures.

This is an error by no means uncommon, even among experienced photographers.

CHAPTER III.

NECESSARY SOLUTIONS.

ONE'S attention must now be turned to the preparation of the necessary solutions, of which the two following are the most important. The tyro is recommended to have them prepared at a chemist's. They should be made as follows, and labelled "Developing Solution A" and "Developing Solution B":—

A. Hydrokinone .. .. 3 drachms
Dissolved in about half an ounce of hot spirit.

Bromide of potassium ... ... 20 grains
And sulphite of soda ... ... 1 ounce

Dissolved in about eight ounces of hot water, then mix the above, and add enough

Water to make... ... ... 20 ounces

B. Place the following in a a pint bottle:—

Hydrate of potassium* ... ... 1½ drachms
Carbonate of potassium ... ... 2 ounces
And add water to make ... ... 20 ,,

Dissolve—

†Alum (powdered) ... ... 1 ounce
In water ... ... 10 ,,

*Not the fluid hydrate, but that in sticks.
†Label this "Alum Solution."

There is but one more solution to be prepared, and that is the "Fixing Solution." It will consist of—

Thiosulphite of soda*	...	...	3 ounces
Liquid ammonia (·880)	...	...	1 drachm
Water to ...	...	...	... 20 ounces

* The old name of "hyposulphite" has been abandoned by chemists because a lower acid forming a series of salts, M_2SO_2, has been since described by Schützenberger, and these are accordingly the true hyposulphites. It would be well for the sake of uniformity . . . if photographers would generally adopt this necessary alteration.—*The Chemistry of Photography*, by . Meldola, F.R.S. London: Macmillan & Co.

CHAPTER IV.

DEVELOPMENT OF THE IMAGE.

WE must now commence the mysterious operations of developing the exposed plates. Take three developing dishes, fill one with some fixing solution, the second with alum solution, and having made the room quite dark, light the red lamp, and place one of the exposed plates face upwards (dull side) in the third developing dish. Take equal proportions of developing solutions A and B to cover the plate.* Pour the mixed solution over the plate in an even wave, and rock the dish gently for a few seconds. If the plate has been exposed for the correct length of time, that which appeared light coloured (*e g.*, the sky) will commence to appear on the plate in about thirty seconds as a black image. If too short an exposure has been given it will take longer; if too long it will appear very rapidly, and a small quantity of water must be added to the developer.

Carefully watch the plate as it is becoming a negative. First the high lights will appear, then the half-tones, and lastly the detail in the shadows.

Do not remove the negative when it appears to be developed enough, but continue until, when held between the fingers in front of the lamp, no light can

*For a half-plate 1½ ounces of each, or for a whole plate 2½ ounces of each.

be seen through the high lights (that is to say, the blackest portions), and all the detail in the shadows (the transparent portions) shows clearly.

It is a common fault with beginners not leaving the plate long enough in the developing solution.

When the negative is sufficient, pour the developing solution back into the measure glass ready for the next plate, and thoroughly rinse the negative several times in cold water, then place it in the alum solution for four or five minutes, after which thoroughly wash again, and place in the fixing solution for fifteen minutes. Daylight may be admitted to the room when the negative has been in that solution for five minutes. After the plate has been fixed, let it wash in a gentle stream of running water for two hours, then place aside to dry. It must not be placed in a hot place while drying, or the film will blister.

During the process of development the plate should be shielded as much as possible from the rays of the lamp, as too much of any kind of light is apt to "fog" it, as it is termed, causing a general smudge over the whole picture.

After negatives have been fixed, light has no effect upon them whatever.

It will be a great help to the tyro if he can find some friend who, being an amateur photographer, will stand by him and advise while he develops his first four plates.

There are a great number of developing solutions now in ordinary use, but my readers must be warned

from trying them. It is far better to learn one process well than thirty indifferently.

It is not so much the developer as the manner in which it is employed that produces either a good or a poor negative. The developer described in the last chapter is one of the simplest to manipulate.

If the above instructions be strictly followed no absolute failure can be possible, but the manipulator will, after a few attempts, have confidence in his own powers, and speedily become a skilled operator.

CHAPTER V.

DEFECTS IN NEGATIVES AND THEIR REMEDIES.

THESE may be classed under a comparatively few headings, viz.: Finger marks, uneven thickness of film, spots, green fog, halation, frilling and blistering, and solarisation, or renewal of the image.

Finger marks show white in prints, and can therefore be rendered invisible by applying a little water-colour paint with a fine camel-hair brush.

Uneven thickness of the film is caused by the plates not being placed in a perfectly level position while the gelatine emulsion, after having been applied, was setting hard. When printing from negatives suffering from this fault, the thin portion should be slightly shaded from light.

Spots consist of four kinds, viz.: (1) Transparent varying in shape; (2) opaque; (3) circular transparent; and (4) very small transparent ones, generally known as "pinholes." Transparent varying in shape, and opaque ones, arise from many causes connected with faulty manufacture of the plates, or through them having been kept for some time in a damp place. Unfortunately, such defects cannot be perfectly obliterated. The most that can be done towards this end is to paint the transparent ones with water colours, so as to make them match, as

nearly as possible, the density of the negative. Circular transparent spots, with clearly-defined edges, are generally caused by a bubble in the developing solution resting on the plate during development. These will be prevented by employing enough developing solution to cover the plate by at least one-sixteenth of an inch, and by rocking the plate during development, so as to break any bubbles that may have been formed. Pinholes are caused by small particles of dust which were present upon the film of the plate during exposure, thereby preventing the light from acting upon it. Plates should always be dusted (and also the inside of the dark slides) when they are placed in the dark slides ready for exposure with a broad camel-hair brush, as used for manipulating gold leaf.

Green fog is one of the often-occurring maladies to which gelatine dry plates are subject. Even the experienced photographer has often to cry out in complaint against this enemy, having many, otherwise perfect, negatives spoilt by it.

The causes of green fog have often been discussed with much interest in photographic handbooks, but no very satisfactory reasons have been forthcoming for its appearance.

Many are agreed that one of the chief causes is an action on a salt differing in its behaviour from that from which the image is formed. As it is liable to appear with almost all developers generally employed, many hold the theory that it owes its birth to a

chemical change taking place in the gelatine film during the exposure. This, however, the author is not inclined to accept, because, if one of a batch of plates particularly liable to this trouble be developed without being previously exposed, it will appear in a worse form than if the plate had been exposed. The accuracy of this statement may easily be tested by making an exposure with the slide drawn only half-way out.

It will generally be found, however, that if such plates are exposed a little longer time than would ordinarily be necessary, and a less quantity of the alkali is employed in the developer, a most decided diminution, if not a total expulsion, of the fog will be observed.

Green fog may be recognised either by transmitted or reflected light. In the former case it presents a pink to a claret hue, and in the latter, on the underside, a greenish metallic colour.

Under-exposed plates are most generally troubled with this fog, which explains the reason why old plates, deteriorated in sensitiveness by age, often present good specimens of it. Bad air or gas fumes will also cause it.

Halation is another great trouble to the photographer. It presents itself in architectural work, by blurring the outline of dark objects against the sky, etc.

The causes of its occurrence are principally two, viz.: (1) Reflection from dust suspended or falling

in the air, and (2) reflection taking place between the two surfaces of the glass plate.

The former cannot be prevented, but the latter may, by using a thickly-coated plate (containing iodide of silver), which has been backed with burnt sienna or moistered with glycerine, and a piece of black Indian cloth squeezed into optical contact with the back. The latter is the cleaner method, though little employed.

Frilling and blistering. When the gelatine film leaves the plate at the edges, or blisters in the middle, the fact may be accounted for by one of the following reasons: (*a*) A too warm developing solution; (*b*) a too strong hypo bath containing an excess of alkali; (*c*) the temperature of the developer, alum bath, hypo both, or washing waters differing from each other; or (*d*) very new plates prepared with soft gelatine.

It occurs with some plates when developed with hydroquinone. In this case, if a solution of ferrocyanide of potassium be employed as a restrainer instead of bromide, neither frilling nor blisters will appear. However, when the film has left the plate in certain places, soak in a saturated solution of alum, fix and wash carefully so as not to tear the film, then place the plate in a tray and pour alcohol over it. Let it remain for about one minute or until the film has become smooth, remove the plate carefully, and allow to dry, when the film will again take up its original position fast to the plate. The alcohol will evaporate quickly.

Solarisation, or reversal of the image, is a strange chemical action caused by the continued action of light upon a photographic plate, which, after a certain point is reached in the formation of the reflected image, the exposure, so to speak, commences to "unexpose."

The reason for this is at the first blush a difficult problem to solve, but upon investigation proves far simpler than might be expected.

Solarisation is not a reversed action of the actinic rays, but of the developer.

A gelatine film upon continued exposure to comparatively strong light becomes less soluble than it was previously. The solarisation which takes place upon a glass negative is far more pronounced than if it had been a film negative; this is owing to halation taking place at the same time, and the less iodide of silver, and the more bromide of silver, contained in the film, the more it will be present. Such parts of the negative as have been most acted upon will be the first to solarise.

CHAPTER VI.

DOCTORING AND FINISHING NEGATIVES.

IT is by no means a rare case that a negative, when it has been fixed, is either too transparent or too dense to produce a good print in that state. To remedy such defects, if it be too thin it must be intensified, and if the reverse reduced, as it is technically called.

The commoner of the two faults is caused by an insufficient action of the developer causing lack of density, to remedy which treat the negative, after all the fixing solution has been thoroughly washed out of the film, as follows :—Immerse it in

Bichloride of mercury	1 drachm
Bromide of potassium	30 grains.
Water	6 ounces.

until the film has become thoroughly bleached, then wash in running water for ten minutes, and soak in

Sulphite of soda	½ ounce.
Water	6 ounces.

until it has become almost black, then rinse well in water.

Both the above solutions may be used a large number of times before they lose their actinic power.

If by any chance the negative was so thin to commence with, that the above operations have not caused it to become as dense as was desired, they may be again repeated.

The case of a too dense negative must now be considered. It may easily be reduced by soaking it for a few minutes in some fixing solution (not old), then pour it into a measure-glass, and add a few drops of the following solution :—

Ferricyanide of potassium	50 grains.
Water	1 ounce.

Pour this over the negative; in a minute or two it will slightly have reduced the density. (During this change the developing dish should be constantly gently rocked.)

If the density has not been sufficiently reduced, add a few more drops of the lastly described solution, as before, until the desired change has taken place, after which wash the negative, and allow it to dry.

As negatives are very liable to get scratched, it is most desirable to varnish them.

Negative varnish may be either purchased, or made as follows :—

Sandarac	2 ounces.
Oil of lavender	2 ,,
Chloroform	1½ drachms.
Alcohol	12 ounces.

Mr. Burton, in his "Modern Photography,"* has so admirably described the process of applying the varnish that the author here reproduces his instructions. "After the negative is thoroughly washed and quite dry, it is taken by that corner which, were it a printed page, would be called the left-hand bottom

*Page 109.

corner. It is warmed gently over a gas-burner till it is just warm enough to feel pleasant to the touch. . . . The plate is now held level by the corner mentioned between the finger and thumb of the left hand. A large pool of varnish is gently poured into the centre of the plate. This pool should cover about half the area of the glass. The plate is gently 'tipped,' so as to cause the varnish to flow first to one corner and then to another, beginning at that opposite to the one by which it is held. When the varnish comes round to the bottom right-hand corner, the plate is tipped slowly up to a vertical position, so that all the excess of varnish may flow back into the bottle. The plate must be rocked from side to side during this part of the process to prevent the formation of crapey lines." The plate must be again thoroughly heated, and as soon as it has become cool may be printed from.

If the varnish has become scratched at any time, it may be removed by rubbing it with a large plug of cotton-wool, moist with ether, or other spirit.

CHAPTER VII.

A SIMPLE PRINTING PROCESS.

THE most simple printing process known to the author, which gives perfectly satisfactory results, is that known as "Pizzighelli Platina."

The paper can be purchased at almost any photographic material shop. It must be kept in a very dry place, although it is necessary to damp it immediately before printing.

The routine of the process is as follows:—Place a printing frame on its face, remove the back, place a negative in the frame, film side up, then take a piece of the platina paper and hold it over a basin of boiling water until the steam has made it quite limp, then place the paper, sensitive side (yellow side) down, on the top of the negative, on the top of which place a piece of oil paper,* and replace the back.

The oil paper is to keep the dampness in the paper from evaporating.

To print, simply place the front of the frame in a strong light until the paper has become sufficiently printed. By removing *one* of the springs and folding down half the back of the frame, the printing may be observed from time to time.

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* As used with a copying press.

When the print is dark enough remove it from the frame and soak it in three baths of the following solution for three minutes in each, then rinse well in cold water, and dry it between clean blotting paper:

Hydrochloric acid	3 drachms.
Water	20 ounces.

This paper may be prepared at home by following the instructions below; however, the author recommends his readers to purchase this paper ready prepared, as great care is necessary in respect to clean hands, dishes, mortars, &c.

"Prepare the following solutions:—

A.	Potassium chloro-platinite	1 part.
	Distilled water	2 parts.
B.	Sodium ferric oxalate	40 ,,
	Powdered gum arabic	40 ,,
	3 per cent. solution of sodium oxalate	100 ,,
	Glycerine	3 ,,

To prepare B the sodium oxalate solution is heated to 120° Fahrenheit, after which the iron salt and glycerine are stirred in. After the former is completely dissolved, the compound is transferred to a mortar, the gum is then added, completely dissolved and well stirred, so as to mix thoroughly with the solution, and then left some hours.

C.	Solution B	100 parts.
	Potassium chloride	0·4 part.
D.	Mercuric chloride 5 per cent. ...	20 ,,
	Sodium oxalate solution 3 per cent ...	40 ,,
	Powdered gum arabic...	24 ,,
	Glycerine	1.8 ,,

Use solution D in the same manner as solution B.

For black tones use the following proportions :—

A.	Platinum solution	5 ounces.
B.	Iron solution	6 „
C.	Chlorate solution	2 „

Or for sepia tones :—

A.	Platinum solution	5 „
C.	Chloride solution	4 „
D.	Mercuric oxalate solution	4 „

Apply either of the above solutions with a stiff brush about 1½in. broad (not tin-mounted), and dispel the air-bubbles which will form with a badger softener.

The paper should be allowed to dry quickly in a warm, dry atmosphere, and kept in chloride of calcium tubes."*

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* *The Art and Practice of Interior Photography*, by the Author, Chapter XI. London : Simpkin, Marshall, Hamilton, Kent & Co., Limited.

PART II.

CHAPTER VIII

PHOTOGRAPHING INTERIORS.

THIS little book would not be complete without some nformation respecting "interior photography," as it is technically termed. It is, however, a branch which should not be attempted until exterior subjects have been thoroughly mastered, requiring, as it does, some practical experience in photography.

The following remarks, it is hoped, will prove of value. A wide-angle lens will be required ; the plate must be thickly coated, and preferably a ground glass one, or a celluloid film. A small stop in the lens while exposing is imperative, or an universal focus cannot possibly be obtained, and the exposure must be somewhat protracted. As the light varies so much in different interiors it is absolutely impossible to concisely direct the exposure required ; however, with f/45, in summer it may vary from twenty minutes to two hours, according to the amount and actinicity of light, and rapidity of plate employed.

When about to expose, precaution should be taken that the camera does not face any window through which the sun is shining, or the result will be an absolute failure.

If reds and yellows are in prominence the plate should be an isochromatic one, as these colours would have little, if any, actinic power upon an ordinary one

The developer most suited for this description of work is the one recommended on page 37. It is a good plan to over-expose the plate; develop with little restrainer until all the detail has appeared, then add restrainer, and continue until sufficient printing density has been obtained.

It is often the case that there are some dark corners in the interior which would ruin the beauty of the print, by presenting meaningless black patches. These may often be prevented by lighting the gas, or even burning magnesium ribbon in several different positions near to the darkest portions for a few seconds.

The remarks in Chapter II. in respect to the use of the swing back must be specially attended to.

The beginner will soon learn by experience to gauge the necessary exposure, and wi l find that this branch of photography is by no means such a difficult one as is generally believed, though it requires considerable care and practice.

As it would be impossible, in the scope of this chapter, to enter upon all the details and intricacies of interior photography, the reader is referred to the work on this subject by the author.*

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* *The Art and Practice of Interior Photography*, by F. W. Mills. London: Simpkin, Marshall, Hamilton, Kent & Co , Limited

CHAPTER IX.

SECOND LESSON IN DEVELOPMENT.

THOSE of my readers who desire to attain a higher goal in photography than merely reproducing details of buildings with little regard to the accurate rendering of light and shade will find the following developing formula greatly aid them.

It must first be clearly understood that a developing solution consists of two constituents, viz.—(1) an oxidiser and (2) an accelerator; to these must often be added a restrainer. The following may be taken as an example. Hydrokinone is an oxidiser, potassium hydrate (caustic potash) being the accelerator, bromide being the restrainer. However, with this developer considerable difficulty will be found in compensating for over or under-exposure.

The following developing solutions will be found to present considerable facilities for rectifying any errors in exposure :—

A.	Liquid ammonia, °880	1 ounce.
	Distilled water	9 ounces.
B.	Potassium bromide	1 ounce.
	Distilled water to make	10 ounces.
C.*	Acid pyrogallic	1 ounce.
	Acid citric	60 grains.
	Sodium sulphite	2½ ounces.
	Distilled water to make	10 ounces.

These solutions will keep almost any length of time.

* Dissolve the acid citric and sodium sulphite in about six ounces of hot water; when this sclution is cold add the acid pyrogallic and make up to ten ounces with water.

They may be labelled respectively, "Ammonia 10 per cent.," "Bromide 10 per cent.," and "Pyro 10 per cent."

The mode of mixing these three solutions previous to development is as follows. Take of

A	... ...	10 minims
B	... ...	25 ,,
C	... ...	10 ,,

to *each* ounce of water.

This solution will not be found to work too rapidly if the exposure has not been too long. If of correct duration, about ten minims of A per ounce may be added towards the end of development of the plate. If under-exposed, continue to add small quantities of A until all the desired detail has appeared, but if the reverse, and the image appears too rapidly, add a small quantity of B, which will retard the development, thereby allowing the plate to become sufficiently dense.

The following short explanation of the action of the different ingredients of the mixed developer may not be out of place here.

"Pyrogallol (pyrogallic acid) gives density and strength of image. This is actually the developing agent; and were plain pyro used the development would proceed, but at a very slow rate. The alkali (ammonia) gives speed in development, and in excess flatness or too much half-tone, or want of density due to general fog. The restrainer gives control over the development, and clearness of picture, preventing the

too forcible action of the developer allowing the detail to appear; but it must be remembered that were the restrainer applied to the plate alone for a sufficiently long period, the latent image would be destroyed." *

If a plate be known to be over-exposed before applying the developer, it may be made into a good negative by first immersing it in ten minims of B solution to each ounce of water for two or three minutes, then add the pyro and ammonia.

Experience is the only reliable guide which can direct the operator as to the exact proportions of A, B and C solutions required for any given exposure. It has often most truly been said that developers must be mixed with brains.

There are numerous formulæ now in use for developing plates. The author, however, considers that one other only may be of value in addition to those recommended, and that one for a special purpose only—the development of celluloid films. It is as follows:—

Pyro Solution—

Pyrogallic acid	¼ ounce.
Sulphite of soda (crystals)	1 ,,
Water to make	16 ,,

Note.—The soda must be dissolved in the water before the pyro be added.

Alkali Solution—

Sulphate of soda (crystals)	2 ounces.
Carbonate of soda (crystals)	2 ,,
Water to make	32 ,,

* *Dictionary of Photography*, by E. J. Wall, page 44. London: Hazell, Watson and Viney, Ltd.

To develop take one ounce of each of the above to two ounces of water. No restrainer will be required unless the film appears to be over-exposed, when ten or more minims of B may be added to each ounce of mixed developer.

The necessary directions for working films are always enclosed in the packets containing them.

It may be mentioned that no developer containing spirit should be used to develop films, as it would have a tendency to dissolve them.

CHAPTER X.

POSITIVE BROMIDE PRINTING.

THIS is, in the author's opinion, the most suitable printing process for reproducing architectural subjects. It has severa important advantages, viz., it is easily manipulated, the printing only takes a few seconds by gas or candle-light, it shows clearly very fine details, and last, but not least, it is a permanent process.

Bromide paper is made in three qualities, known respectively as—

A. Thin paper with a smooth surface.

B. Thick paper with a smooth surface; and

C. Thick paper with a rough surface.

B paper will be found the most convenient for the present purpose. It may be purchased from any good photographic material dealer.

The packets must only be opened in the red light of the dark room, as the paper is almost as sensitive to light as plates.

The details of printing by this method are as follow:—

The sensitive emulsion side of the paper is placed next to film side of a negative in the printing frame. The necessary length of exposu re varies according to the

density of the negative, and the active power of the light employed; as a guide, however, the negative being a good average one, about two seconds in diffused daylight, and twenty seconds held one foot from a large gas burner, will be found correct. The paper must be taken out of the printing frame and developed in red light only.

The most convenient developer will be found that recommended on page 19 for plates. It may be used over and over again, until it becomes dark by absorption of oxygen. The developer known as the ferrous oxalate is also to be commended, but as instructions for its preparation and use are enclosed in each packet of this paper by the makers, it is thought undesirable to occupy space by repeating those particulars.

In the red light of the dark room many find a difficulty in discovering which is the sensitive side of the paper. The careful observer will note that each sheet curls slightly at the edges, making the paper dished. The hollow portion is the sensitive side. In case it has been pressed quite flat, the film side may be easily detected by damping one corner at each side, when it may be recognised by its stickiness.

The paper having been exposed in the printing frame as above described, a *perfectly clean* developing dish should be filled with water, the paper immersed in this, film side uppermost, and the water poured away, leaving the paper sticking to the bottom. Now pour enough developing solution over it to

thoroughly immerse it. In about ten seconds the image, as the picture is technically termed, should commence to appear. If it takes longer the exposure has not been long enough, and if shorter too long. The positive, as the print is now called, should be allowed to remain in the developer until it is much darker than it will be desired when finished.

Pour the developing solution back into the measure glass, ready for another print, and thoroughly well rinse the positive with cold water,* and then place it in a solution of

Alum	2 ounces
Water	10 ,,

for ten minutes, then thoroughly well rinse and place in a newly-made fixing bath for ten minutes. The fixing bath is described on page 20. After this bath it should be well washed and again placed in the alum bath to strengthen the gelatine film of which the image consists. Then wash again. Excess of water may be removed with blotting paper, and the print spread out to dry. It must not be held before a fire to hasten drying, or the heat will blister the delicate gelatine film.

The above process gives very beautiful permanent results, and is far simpler to manipulate than would be supposed from the above minute description.

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* If the developer employed is ferrous oxalate, the positive must not be rinsed immediately after development with water, but with a little of the following solution, two or three times :—

Acetic acid	1 drachm
Alum	2 ounces
Water	30 ,,

The new eikonogen developer has received so much praise by experts that is it quite possible that some who peruse these pages may desire to see for themselves its developing power.

A. Sulphite of soda*	1 ounce
Eikonogen	1½ drachms
Water	30 ounces
B. Carbonate of soda (crystals)	1 ounce
Water	10 „

To develop take of—

Solution A	3 ounces
„ B	1 „

No acid bath will be required after this developer

*Dissolve the soda thoroughly before adding the eikonogen.

CHAPTER XI.

PLATINOTYPE.

HOT BATH.

AS it is presumed that the sensitive paper is purchased ready for exposure, the following directions only need be followed; but a few words may with advantage first be said as to the theory of the process.

The paper is sensitised with ferric oxalate and chloride of platinum, and after drying it must be kept quite dry. For this reason a sheet of india-rubber should always be placed behind it, in the printing frame, so as to prevent moisture from the atmosphere being absorbed. Light acting on the platinotype paper has the effect of decomposing the ferric oxalate into ferrous oxalate and carbonic anhydrate.

The paper is exposed to diffused daylight (not in the sun) in the usual manner, in an ordinary printing frame, the sensitive side of the paper (the yellow) being placed against the film of the negative, and a piece of india-rubber placed at the back of the paper in order to prevent the dampness of the atmosphere causing the paper to print in uneven blotches.

The lemon-yellow tint of the paper becomes greyish when affected by light, and sometimes, when, the negative contains great contrasts, pure yellow in the shadows.

Only experience can teach when the exposure is complete, but, fortunately, there is a wide latitude permissible. It may, however, be taken as a general rule that the detail in the shadows shall be visible before the paper be removed from the printing frame.

It is a good plan, if the negative be a "flat" one, that is to say, wanting in contrasts, to varnish the rebates with opaque varnish. The edges of the paper will, therefore, during exposure, remain unchanged, as no light will reach them.

The printed portion may then be estimated as to its density with considerable accuracy.

Direct sunlight should only be employed when the negative be very dense, *i.e.*, black and white.

Possibly the best devoloping solutions for the paper are as follows (although various modifications have been recommended) :—

To develop the exposed paper float it upon a saturated solution of potassium oxalate made faintly alkaline with sodium carbonate. This is heated to from 100° to 150° Fahrenheit, according to the exposure. An under-exposure may even be treated with a solution as hot as 190°*.

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* A weak solution of carbonate of soda, or of other alkaline salts, such as sodium phosphate, may be used to develop the prints, instead of potassium oxalate, especially when the prints have been over-exposed, or the paper has a tendency to fog by reason of its having been kept over long. The action of the sodium carbonate appears to be rather to retard the solution of the iron salts, and so to give them time to reduce the platinum, than to develop the image in the sense that potassuim develops it. It is advisable not to commit those errors that give the advantage to such salts as those mentioned.—*Science and Practice of Photography*, Chapter XVIII., by Chapman Jones, F.I.C., F.C.S. London : Iliffe & Son.

The prints, after developing, should be placed in a solution made as follows:—

Hydrochloric acid	½ ounce
Water	20 „

without being previously washed. If by any chance this fixing solution presents a slightly milky appearance, it is not strong enough in acid, and more should be added without delay.

The prints may be changed from this solution to a similar one three or four times, remaining in each three or four minutes. This must be continued until the last solution, after having received them for some minutes, does not turn yellow.

The prints should be then thoroughly washed, and will be quite permanent.

The Platinotype Company sell paper and solution for producing sepia tones, the mode of preparation of both of which is unknown to the author, but the following developing solution (Borlinetto's) gives the same result:—

Saturated solution of potassium oxalate	10 ounces
Saturated solution of cupric chloride ...	1 ounce
Oxalic acid	1 drachm

The prints should remain in this solution from ten to twenty minutes if necessary.

Cold Bath.—The paper for this process is purchased ready prepared with ferric oxalate, to which some ~~mercuric~~ Platinic chloride has been added.

It may, however, be easily prepared by being previously sized with the following solution:—

Arrowroot	1 drachm.
Hot water	5 ounces.

(The solution must be cold when employed.)

Lay the paper flat upon the solution, taking care that no air-bubbles are present, for three minutes, then hang up to dry.

The paper may then be sensitised by floating for two minutes upon the following solution :—

Ferric oxalate	5 drams.
Mercuric chloride	5 grains.
Water	5 ounces.

The paper is then dried, and again floated a second time for a few seconds upon the last solution, and dried again.

The mode of developing prints with a cold solution was fully explained by its introducer, Mr. W. Willis, at the Conference of the Camera Club, two years ago.*

The cold is far superior to the hot bath process, as shorter exposure is required, and a wider latitude in exposure is permissible. It has also the advantage of allowing the printer to vary considerably the character of his prints.

Prints may be kept several days (in a dry atmosphere) before being developed without any appreciable deterioration taking place. However, they should be slightly damped before printing or before developing, as paper exposed n a perfectly dry state, and developed without being previously damped, will give but a comparatively feeble grey print, whilst if they are damped they will assume a rich, velvety appearance.

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* See the *Journal of the Camera Club*, Vol. II., p. 47.

To damp the paper, spread it out upon clean sheets of blotting paper (in the dark room) for about ten minutes in winter or twenty in summer. A simple rule to be guided by is that the paper is moist enough immediately it loses its crispness.

In developing the prints many variations may be made, both in the constitution of the developer and in the method of applying it. Different proportions and quantities of oxalate and of platinum salt may be used. The following bath, which is employed by the author, will prove, however, of good average strength :—

Potassium oxalate	35 to 65 grains
Potassium chloro-platinite ($3K_2 Pt Cl_4$)...	9 „
Water	1 ounce

It must, however, be borne in mind that the stronger the oxalate the harder and colder will be the tones.

The Platinotype Company, in their instructions supplied with this paper, give the following formula :—

A. Developing salts *	½ pound
Water	50 ounces
B. Platinum salts ($3K_2 Pt Cl_4$)	60 grains
Water	4 ounces

* Potassium oxalat (neutral).

The developer is made by mixing three parts of A to one of B, and adding two parts of water.

Do not mix more developer than will be sufficient to develop your exposed prints, as the solutions when mixed will only keep a few hours.

Small prints are best developed by floating, but large ones by being brushed with a large squeegee (the breadth of the print) covered with flannel soaked in the developing solution.

The acid bath above described on page 47 must be applied immediately the development has proceeded far enough.

Unexposed platinotype paper should always be preserved in a chemically-dry state. To accomplish this it is convenient to place it in long, circular tin cases (similar to those of card-board used for silver paper), with a perforated false bottom, below which is anhydrous calcium chloride, and having strong indiarubber bands round the joinings between the lids and the bodies of the cases. Such cases may be purchased ready made at almost any photographic apparatus dealer's.

When opening or closing the case care must be taken that no metallic dust finds its way on to the paper. The calcium tubes should always be lined with felt or cloth.

It is a fact, worthy of note, that negatives or fingers which have been in contact with platinotype paper prepared for the hot bath process must be thoroughly cleaned before touching cold-bath paper.

CHAPTER XII.

ENLARGING ON BROMIDE PAPER.

IN the early part of this little book the author has recommended his readers not to employ a camera smaller than "whole-plate," or the proofs will be too small to show clearly architectural detail. Such a camera will be found somewhat cumbersome if taken on a walking or bicycling tour, when one may often discover buildings possessing certain features which would be of value. In such cases a small hand camera for plates (or roll holder) measuring five inches by four inches would prove most convenient. The most simple method of producing enlarged prints from such small negatives is to employ a similar apparatus as that illustrated in fig. 5, which may be purchased for a small sum.

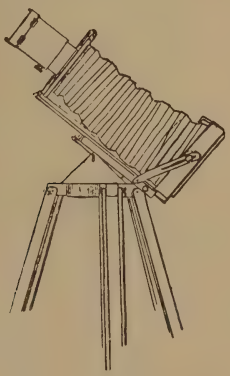

FIG. 5.

The apparatus consists of two small boxes, one sliding within the other, and a tilting board to screw on the tripod top, by which your larger camera may be tilted towards the light. At one end of the smaller box is attached the front of your large camera. At the back of the inner box is screwed the lens flange; at the reverse end of the outer box there are two grooves; in the inner one is placed the negative, a piece of ground glass in the outer one for diffusing the light.

A piece of bromide paper having been placed in the dark slide, which is then adjusted in the camera, the exposure is made by removing the lid of the negative box. The paper is developed as described in Chapter X. Half the quantity of developer sufficient to develop a plate of the size of the bromide paper, with equal bulk of water added, will be found to give better results than a stronger solution. The table here given will prove useful for enlarging by the method above described.

The object of this table is to enable any manipulator who is about to enlarge (or reduce) a copy any given number of times, to do so without troublesome calculation. It is assumed that the photographer knows exactly what the focus of his lens is, and that he is able to measure accurately from its optical centre. The use of the table will be seen from the following illustration:—A photographer has a *carte* to enlarge to four times its size, and the lens he intends employing is one of six inches equivalent focus. He

must therefore look for 4 on the upper horizontal line, and for 6 in the first vertical column, and carry his eye to where these two join, which will be at 30—7½. The greater of these is the distance the sensitive plate must be from the centre of the lens; and the lesser, the distance of the picture to be copied. To *reduce* a picture any given number of times the same method must be followed, but in this case the greater number will represent the distance between the lens and the picture to be copied; the latter, that between the lens and the sensitive plate. This explanation will be sufficient for every case of enlargemen or reduction.

If the focus of the lens be twelve inches, as this number is not in the column of focal lengths, look out for 6 in this column and multiply by 2, and so on with any other numbers.

TABLE FOR ENLARGEMENTS.*

Focus of Lens inches.	*Times of Enlargement and Reduction.*							
	1 inch.	2 inches.	3 inches.	4 inches.	5 inches.	6 inches.	7 inches.	8 inches.
2	4 4	6 3	8 $2\frac{3}{4}$	10 $2\frac{1}{2}$	12 $2\frac{2}{5}$	14 $2\frac{1}{3}$	16 $2\frac{2}{7}$	18 $2\frac{1}{4}$
$2\frac{1}{2}$	5 5	$7\frac{1}{2}$ $3\frac{3}{4}$	10 $3\frac{1}{3}$	$12\frac{1}{2}$ $3\frac{1}{8}$	15 3	$17\frac{1}{2}$ $2\frac{11}{12}$	20 $2\frac{6}{7}$	$22\frac{1}{2}$ $2\frac{13}{16}$
3	6 6	9 $4\frac{1}{2}$	12 4	15 $3\frac{3}{4}$	18 $3\frac{3}{5}$	21 $3\frac{1}{2}$	24 $3\frac{3}{4}$	27 $3\frac{3}{8}$
$3\frac{1}{2}$	7 7	$10\frac{1}{2}$ $5\frac{1}{4}$	14 $4\frac{2}{3}$	$17\frac{1}{2}$ $4\frac{3}{4}$	21 $4\frac{1}{5}$	$24\frac{1}{2}$ $4\frac{1}{12}$	28 4	$31\frac{1}{2}$ $3\frac{15}{16}$
4	8 8	12 6	16 $5\frac{1}{4}$	20 5	24 $5\frac{4}{5}$	28 $4\frac{2}{3}$	32 $4\frac{4}{7}$	36 $4\frac{1}{2}$
$4\frac{1}{2}$	9 9	$13\frac{1}{2}$ $6\frac{3}{4}$	18 6	$22\frac{1}{2}$ $5\frac{5}{8}$	27 $5\frac{2}{5}$	$31\frac{1}{2}$ $5\frac{1}{4}$	36 $5\frac{1}{7}$	$40\frac{1}{2}$ $5\frac{1}{16}$
5	10 10	15 $7\frac{1}{2}$	20 $6\frac{2}{3}$	25 $6\frac{1}{4}$	30 6	35 $5\frac{5}{6}$	40 $5\frac{5}{7}$	45 $5\frac{5}{8}$
$5\frac{1}{2}$	11 11	$16\frac{1}{2}$ $8\frac{1}{4}$	22 $8\frac{1}{8}$	$27\frac{1}{2}$ $6\frac{7}{8}$	33 $6\frac{1}{2}$	$38\frac{1}{2}$ $6\frac{5}{12}$	44 $6\frac{3}{7}$	$49\frac{1}{2}$ $6\frac{3}{16}$
6	12 12	18 9	24 8	30 $7\frac{1}{2}$	36 $7\frac{1}{6}$	42 7	48 $6\frac{6}{7}$	54 $6\frac{3}{4}$
7	14 14	21 $10\frac{1}{2}$	28 $9\frac{1}{3}$	35 $8\frac{3}{4}$	42 $8\frac{2}{5}$	49 $8\frac{1}{6}$	56 8	63 $7\frac{7}{8}$
8	16 16	24 12	32 $10\frac{2}{3}$	40 10	48 $9\frac{3}{5}$	56 $9\frac{1}{3}$	64 $9\frac{1}{7}$	72 9
9	18 18	27 $13\frac{1}{2}$	36 12	45 $11\frac{1}{4}$	54 $10\frac{4}{5}$	63 $10\frac{1}{2}$	72 $10\frac{2}{7}$	81 $10\frac{1}{8}$

*From the *British Journal of Photography Almanack.*

CHAPTER XIII.

SPECIAL APPLIANCES.

IT is often desirable, when travelling, to photograph for oneself certain architectural features of a building which are not shown in any photographs that can be bought.

The weight of glass plates would prove a great nuisance, besides the great inconvenience of not having a dark room always at hand to empty and refill the dark slides. To obviate this difficulty, compact and light boxes are made to take the place of dark slides, called "roll-holders." These roll-holders contain two rollers, one having a long spool of flexible celluloid coated upon one side with the same emulsion as are plates. As each exposure is made, the exposed portion of the spool is wound on to the other roller. Fig. 6 represents one of these roll-holders.

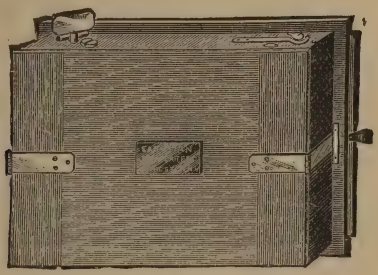

FIG. 6.

When the roll-holder is placed in position, a portion of a continuous roll of sensitive film is brought into the plane occupied by the ground glass whilst the image was being focussed. Between this film and the lens there intervenes nothing but a shutter similar to that used with an ordinary dark slide. In fact, the film on its basis simply replaces the film on glass, but with this great difference, that when it is necessary to replace one film with another, instead of having to reverse the slide, or take up another one, we have only to turn a key till a certain indication is given, when, by the winding of the exposed film on to one roller, and the unwinding of an unexposed one from the second roller, we have a fresh film in position.*

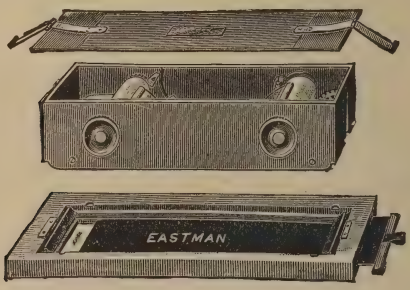

Fig. 7.

From fig. 7 may be easily seen the construction of the roll-holder. To remove the lid press the springs at each end of the holder inwards.

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* *Burton's Modern Photography*, page 113. London: Piper and Carter.

An exposed portion may be cut off with a knife by drawing it along the rollers, as illustrated in

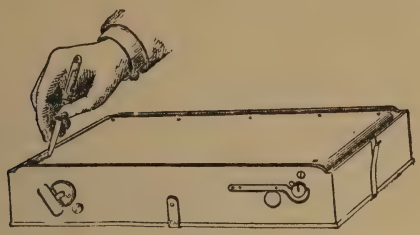


FIG. 8.

fig. 8. The remainder of the spool must then be pulled, so as to unroll it, and passed through the slit into the box, and attached as in the illustration (fig. 9).

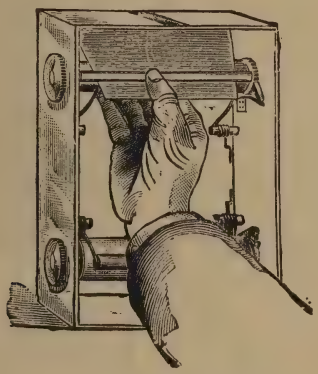


FIG. 9.

One other piece of apparatus which calls for notice on account of its usefulness to architects is an ingenious camera particularly adapted for photographing panoramic views. The "Cylindrograph," as the inventor, M. Moessard, has named it, was patented by him in 1884. Fig. 9 illustrates this camera ready for use

When it is desired to focus, the crank (*m*) is moved from side to side. If the image on the ground glass remains stationary when the lens (*p*) is moved by means of the crank, the focus is accurately adjusted. Should, however, the image move in the same direction as the crank, the lens must be moved further forward; if in the opposite direction, the lens must be brought a little nearer to the focussing screen. A few turns of the screws will effect the necessary alteration.

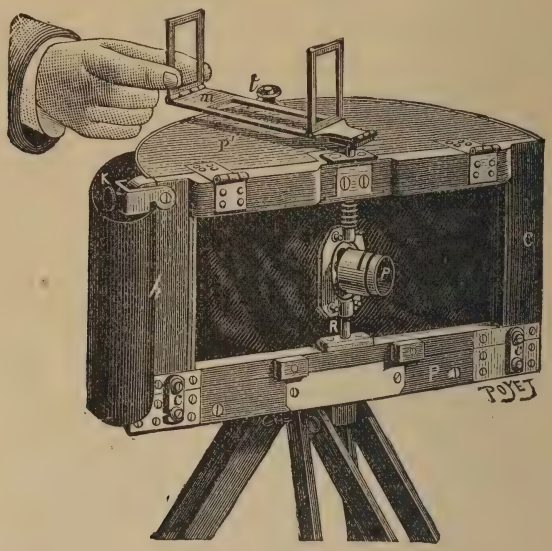


FIG. 10

The sizes of the films used with this camera are as follows:—

SIZE OF FILM.	FOCUS OF LENS.
17½ × 5 inches	6 inches
23½ × 7 ,,	8 ,,
29 × 9 ,,	10 ,,
34½ × 10½ ,,	12 ,,

The whole apparatus closes into the small space shown in fig. 11.

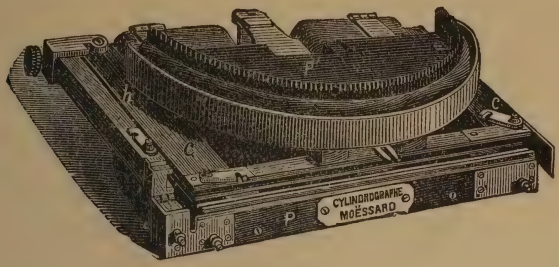


Fig. 11.

CHAPTER XIV.

PROCESSES FOR COPYING TRACINGS.

THESE processes may be divided under two headings, viz.: (1.) White lines on a blue ground, and (2), black lines on a white ground.

The former is now well known, being employed largely by engineers and by a few architects; the latter, however, is by no means so well known. The print opposite is an illustration of it.

The author advises his readers to purchase their ferro-prussiate paper, but for the benefit of the few who may desire to prepare their own, and thus save expense, the following particularly simple method is described.

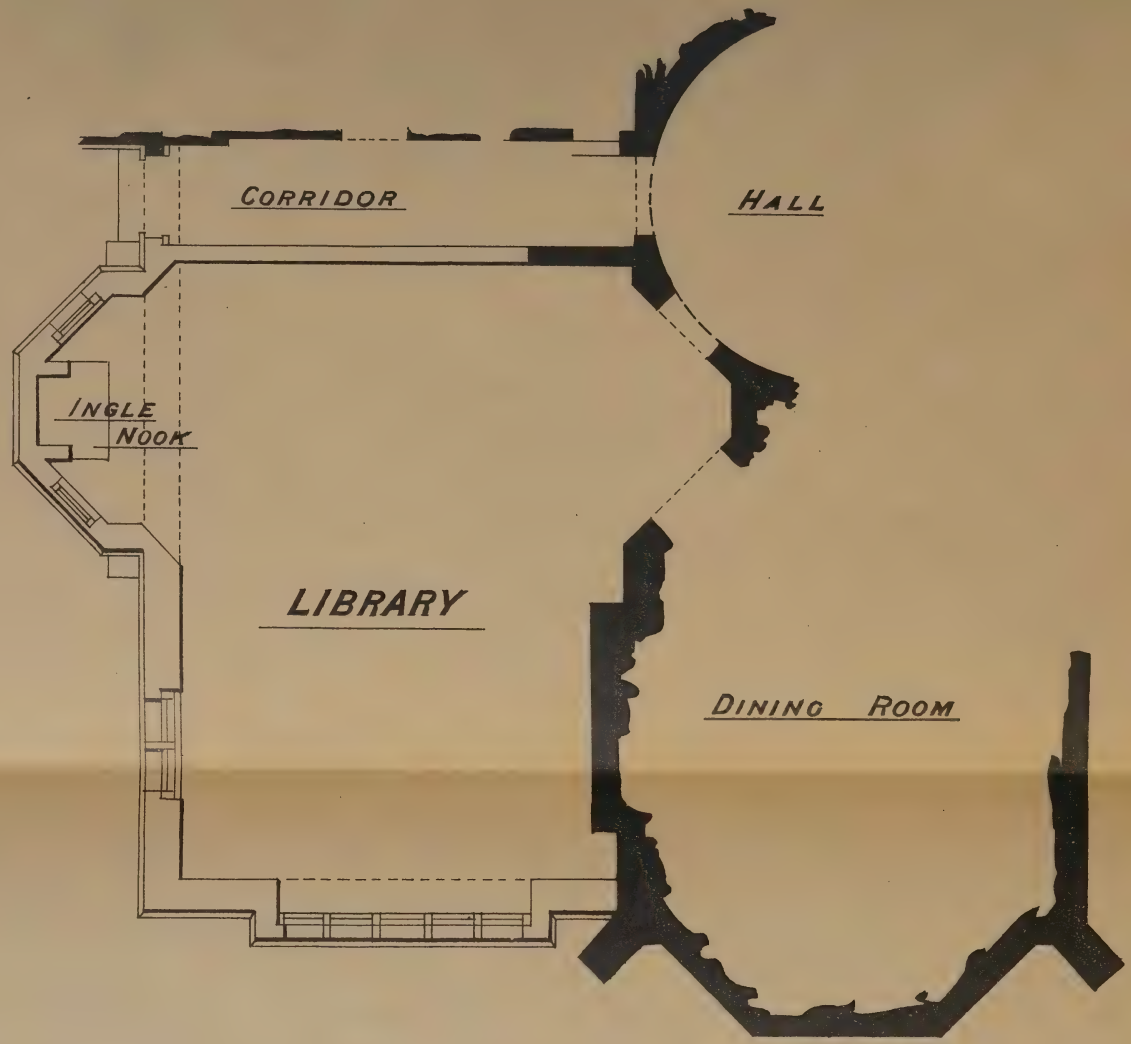
Ordinary Ferro-prussiate Process.—Dissolve

Potassium ferricyanide	2½ ounces.
In water	10 „

and

Ammonia citrate of iron	2½ ounces.
In water	10 „

Spread a sheet of stout, smooth drawing paper on a drawing board, and with a soft sponge dipped in a mixture of the two above-described solutions, stroke the paper first lengthways, then across, taking care that no portion be missed. So long as the paper has been coated all over, it matters but little whether it be evenly done or not.



Scale 8 Feet per Inch.

GROUND PLAN.

This should be done in a weak light, and the paper must be dried in a very dark place, and preferably warm. Paper so prepared and kept dry will keep for weeks.

To print upon it (or similar paper which has been purchased already prepared), the following simple instructions only need be followed:—Place a piece of clean glass in a large printing frame, and behind it the tracing to be copied, the ink side towards the glass, then a piece of ferro-prussiate paper with the coloured side to the back of the tracing, place the back on the frame, and clamp down the springs.

As in all other photographic printing processes, light is the agent employed to cause the chemical change which produces the print. Place the printing frame in a good light (not in the sun), and leave it there until the groundwork turns slightly bronze colour. This will take about ten minutes on a bright summer day, and on a dull day, in winter, possibly half-an-hour.

Take the paper, when printed enough, out of the frame, and lay it upon a slab of glass or zinc, allowing a tap of cold water to run over it until the water which runs off ceases to be of a yellow tinge.*

Positive Blue Process.—The following process has great advantage over the one previously described, but on account of it being less simple is little used. It is known by some as "Pizzighelli's Blue Process."

*If the background is not intense enough in colour, dip the print in a weak solution of hydrochloric acid in water.

A.	Gum arabic	3 ounces
	Water	15 ,,
B.	Citrate of iron and ammonia	1½ ,,
	Water	3 ,,
C.	Ferric chloride	1 ,,
	Water	2 ,,
D.	Potassium ferrocyanide (yellow prussiate of potash)	2 ,,
	Water	20 ,,
E.	Hydrochloric acid	2 ,,
	Water	20 ,,

A, B and C are mixed, and paper is coated with it as soon as possible, just as described in the last process. The exposure is very short, being only about half or one-third that necessary with sensitised albuminised paper.

After exposure (in the printing frame), D is applied with a brush till the image appears blue on a white ground. If the ground be darker than very *light* blue, this shows that the exposure has been too short. The print is now dipped in F, which removes the slight tint from the ground and darkens the lines. It is washed and dried.* This process is known as "Cyanotype."

Black Lines on White Ground.—This is a process more suited to architects than either of the above, as it presents the appearance of a lithographic print. It is an improvement upon Herschell's positive pro-

* *Practical Guide to Photography and Photo-mechanical Printing*, by W. K. Burton, p. 354. London: Marion & Co., Soho Square.

cess (the one lastly above described) by Pizzighelli and Pellet and Co. Pellet's formula is—

Oxalic acid	5 grains
Ferric chloride	10 ,,
Water	100 cc.

A well-sized paper is coated with this solution, and after it has dried, and been printed upon in the usual manner, it is developed by soaking in a 15 per cent. solution of ferrocyanide of potassuim, then thoroughly washed in water, after which it requires fixing in a 10 per cent. solution of hydrochloric acid. A final washing and drying between blotting paper completes the operations.

Portwin's Process.—As this chapter would not be complete without a description of this process, it is here described.

The paper is first floated on a warm solution of gelatine (1 to 15), to which some suitable pigment has been added.

When dry it is sensitised by immersion in the following simple solution :—

Ferric chloride	480 grains
Tartaric acid	144 ,,
Water	10 ounces

The paper is dried in the dark. The effect of the action of light is to convert the ferric chloride to ferrous chloride in those parts on which the light has acted, thus rendering the gelatine coating insoluble in hot water, where it is in contact with the ferrous salt.

It will be seen, therefore, that a reversed positive is necessary to yield a positive print.

When sufficiently printed, the image is developed by simple immersion in hot water.

The insoluble parts remain in the paper and form the image.

The great drawback to the process is the necessity of printing from reversed positives,* but it is probable that this defect might be remedied.†

*Or negatives.

† *Photographic Printing Methods*, by W. H. Burbank, page 23. New York: Scoville Manufacturing Company.

APPENDIX.

LIST OF CHEMICALS REQUIRED.

For developing solution recommended in Chapter III.

- Hydrokinone, ℥i.
- Bromide of Potassium, ℥i.
- Sulphite of Soda, ℥vi.
- Hydrate of Potassium, ℥iv.
- Carbonate of Potassium, ℥iv.

For finishing negatives—Alum, 1lb. Thiosulphite of Soda, 7lbs.

WEIGHTS AND MEASURES.

TROY WEIGHT.

Pounds.		Ounces.		Pennyweights.		Grains		Grams
1	=	12	=	240	=	5,760	=	373·25
		1	=	20	=	480	=	31.10
				1	=	24	=	1·55

APOTHECARIES' WEIGHT.

(The pound, ounce, and grain are the same as in Troy weight).

lb. ℥ ʒ ℈ gr.

Pound.		Ounces.		Drams.		Scruples.		Grains.		Grams.
1	=	12	=	96	=	288	=	5,760	=	373·25
		1	=	8	=	24	=	480	=	31·10
				1	=	3	=	60	=	3·89
						1	=	20	=	1·30
								1	=	·06
								(15½	=	1·00

AVOIRDUPOIS WEIGHT.

Pound.		Ounces.		Drams.		Grains. (Troy.)		Grams.
1	=	16	=	256	=	7,000	=	453·60
		1	=	16	=	437·5	=	28·35
				1	=	27·34	=	1·77

LIQUID MEASURE.

60 minims	...	...	1 drachm.
8 drachms	...	...	1 ounce = 1·73 cub. ins.
20 ounces	...	...	1 pint = 34·68 ,,
8 pints	...	...	1 gallon = 277·25

N.B.—The imp. gallon is exactly 10 lbs. avoirdupois of pure water.

The pint is $1\frac{1}{4}$ lbs.

The above weights are those usually adopted in formulæ.

All chemicals are usually sold by avoirdupois weight, in which there are $437\frac{1}{2}$ grains to the ounce.

The precious metals, such as silver and gold, are sold by troy weight, containing 480 grains to the ounce.

FRENCH WEIGHTS AND MEASURES.

AND THEIR EQUIVALENTS IN ENGLISH.

1 cubic centimètre	=	17 minims nearly.
$3\frac{1}{2}$,, ,,	=	1 drachm.
28·4 ,, ,,	=	1 ounce.
50 ,, ,,	=	1 ounce, 6 drachms, 5 minims.
100 ,, ,,	=	3 ounces, 4 drachms, 9 minims.
1000 ,, ,, or 1 litre, = to 61 cubic inches	=	35 ounces, 1 drachm, 36 minims.

The cubic centimètre, usually represented by 'c. c.', is the unit of the French measurement for liquids. It contains 16.896 minims. The weight of this quantity of water is one gramme. Hence it will be seen that the cubic centimètre and the gramme bear to each other the same relation as our drachm for solids and the drachm for fluids, or as the minim and the grain.

An easy way to convert grammes into English is to divide the sum by 4, which gives the equivalent in drachms very nearly thus :—

Grammes.				Drachms.	Ozs.	Drachm.		Grains.
100	÷	4	=	25	= 3	. 1	+	43

INDEX.

PAGE

Acid Bath 33, 43, 47
Alum Solution 19, 43
Ammonia 10 % Developing Solution 37
Apparatus 7
Aperture of Lens 9
Backing Plates, Methods of 27
Blisters and Frilling 27
Bromide Printing Process 39
Camera 8
Camera Stand 10
Colour, Chemical Action of 13
Dark Room 9
Dark Room Lamp... 13
Density of Negative 29
Detail... 16
Developers for Plates 19, 37, 39
Developers for Bromide Paper 42
Developers for Platinotype Prints 47, 49
Eikonogen as a Developer 44
Exposure of Bromide Paper 41
Exposure of Platinotype Paper 45
Exposure Table 17
Ferro-prussiate Process 60
Fixing Solution 20
Fog, Green 25
Formulæ for Developers 19, 37, 39, 42, 47, 49
Frilling 27
Gelatine Bromide Paper 41
Gelatine Bromide Plates, Exposure of... 14

Gelatine Bromide Plates, Developing 11
,, ,, Fixing, &c. 20
Green Fog 25
Halation, Causes of 26
Halation, Prevention of 26
Hydrokinone Developer 19
Hyposulphite (see Thiosulphite)... 20
Hydrochloric Acid Fixing Bath... ... ... 33 47
Image, Development of 21
Image, Reversal of 28
Intensifiers for Gelatine Plates 29
Lens 15
Lens, Definition of Wide-angle 8
Light, Chemical Action of 13
Light, Reflection of 26
Mercury Intensifier 29
Over Exposure 38
Paper, Bromide 41
Pizzighelli's Platina 32
Platinotype Printing Process 43
Prism. 13
Pyrogallic Acid Developer 37, 39
Reduction of Negatives 30
Reversal of the Image 28
Rol Holders 55
Sensitive Papers ... ... 32, 41, 43 ,60
Spectrum 13
Stand for Camera 10
Stops 9
Thiosulphite Fixing Bath... 20
Tripod 10
Under Exposure 39
Varnish, Negative 30
Visual Rays... 13
Weights and Measures 65

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